# Goddard Space Flight Center 2009 Sample Student Projects

## Required Academic Level

Graduate/Masters,
Graduate/Doctorate

**Category**

*Computer & Info. Sci*

**Subcategory**

*Information Systems*

## Project Title

***Earth-Moon Libration Orbit Analysis for the Artemis Mission Using the GSFC CAVE***

## Project Description

This project is a combination of two technology challenges. The intern will investigate the stability of the Earth-moon system as applied to the Artemis mission and reconstruct this trajectory information in the GSFC's Flight Dynamics Cave. Beginning in the fall of 2009, the Artemis project will transfer two spacecraft from Earth bound elliptical orbits to Earth-moon libration orbits by way of a weak stability trajectory. The libration orbits are inherently un-stable and predicted behaviors are not completely understood. Significant considerations in the analysis include gravitational and un-modeled perturbations as we utilize the dynamics of the Sun-Earth and Cis-lunar system. Multiple coordinate systems, targeting & optimization, and numerical integration methods will be applied. Part of the project will be to investigate the sensitivity of the trajectory to the perturbations and the required velocity changes for attaining the final orbit and performing station-keeping once in the libration orbit. Once a trajectory is designed, it needs to be visualized in a 3-D simulation environment. This environment is the CAVE, a fully immersive 3-D facility. The intern will perform analysis using state-of-the-art Goddard trajectory design software, Matlab, and the CAVE. The final analysis and visualizations will be used to support the Artemis mission.

## Mentor's Expectation of Student

At the end of the summer session, to have a completed visualizations of the Artemis mission in the Earth-moon system visualized.

## Discipline of Project and/or Background Needed to successfuly complete the project

Astrophysics; Computer Hardware; Graphics; Image Processing; Engnr: Aero/Astronautics, Control Systems, Design, Analysis; Physics; Computer Science

## Skills

Problem Solving, Computer Vision, DOS, Linux/Unix, Windows, STK